RIVERS.

The principal event of the month was the flood on the Wisconsin River, which was caused by torrential rainfalls over the upper watershed on the 23d and 24th. The losses aggregated more than half a million dollars. A full report on this flood appears elsewhere in a separate article.

The stage of water in the upper Mississippi River was amply sufficient for navigation all the month.

MISCELLANEOUS.

Winds from a southerly direction predominated, the prevailing direction being south at 90 stations, southwest at 75, and southeast at 52. The highest velocity reported was 80 miles an hour, from the northwest at Minneapolis, Minn., on the 12th in connection with the severe thunderstorm there on that date. For one minute the wind blew at the rate of 90 miles an hour.

The percentage of sunshine for the district as a whole was about 70, which is close to the normal. There was a slight deficiency in the north and a corresponding excess in the south. The average number of clear days was 15; partly cloudy, 11; cloudy, 5.

LOCAL STORMS IN JULY, 1912.

By U. G. PURSSELL, Section Director, Minneapolis, Minn.

Severe local storms occurred at Campbell on the 8th, buildings being blown down; at Fergus Falls on the 8th–9th much damage was done to trees and buildings; at Grand Meadow a tornado overturned many windmills and did much damage to trees, crops, and barns.

By CLARENCE J. ROOT, Section Director, Springfield, Ill.

Sone unusually heavy rainfalls were reported from various sections of the State. The principal of these was at Alton on the night of the 13th–14th. No station is maintained at Alton, but our observer at Edwardsville, 13 miles distant, Mr. W. H. Morgan, says "The storm of the 13th–14th began as a light rain at 11 p. m. of the 13th, increasing until 12.30 a. m. of the 14th, from which time it rained until 3 a. m. with terrific violence. (Total, 6 inches.)" District Forcaster Montrose W. Hayes, of the St. Louis station, visited Alton in person and made a full and complete report of the storm, which appears elsewhere. A heavy rain at Lake Como in the northern part of the State on the 13th washed out the tracks of the Chicago & Northwestern Railway. The observer at Mascoutah says, "On the 6th, 4 miles south of here in Englemen Township, there was a heavy rain (3.6 inches), attended by thunder and lightning, while only 0.2 inch fell here and 4 miles north it did not lay the dust." The heaviest downpour in the history of the station occurred at Springfield on the 6th. Two and seventy-four one-hundredths inches of rain fell in one hour, and 1 inch in a fraction over 11 minutes. The greatest previous record for 1 hour was 1.57 inches, June 7, 1896. Cellars and basements were flooded. Damage by washing occurred in the parks and the street-car subways were impassable. Heavy rains occurred on the 20th and 21st in the northern part of the State. At Freeport the Pecatonica River caused considerable damage from high water. Crops, while injured in places were greatly benefited by the rain. In Fulton County the Spoon River overflowed portions of the bottom, destroying much corn and oats. A heavy rain of 2.67 inches fell at Peoria. Thousands of dollars damage was done in Peoria and the surrounding country. Peoria is rather hilly and the water running through the ravines caused considerable washing. The storm was at its worst in the upper end of the city, where many basements were flooded and some walls injured. In the country some bridges were carried away and crops suffered heavily. At Antioch, on the 13th, 5.1 inches of rain fell in five hours.

As a result of the numerous thunderstorms, much damage was caused by lightning and wind. The following notes contain the information available at this office:

Mr. R. T. Lindley, local forecaster, Cairo, Ill., reports as follows regarding a storm at Cairo on July 5, 1912: "A local storm, described in the press as a tornado, but which appears not to have had the funnel-shaped cloud characteristic of the tornado, crossed this city between 4 and 5 p. m. The undersigned was absent from the city at the time of occurrence, but from the description of accurate observers the storm was probably a squall, attending the passage of a severe thunderstorm. Lightning struck the building in which our office is located within a few feet of the instrument shelter, the damage being slight. The extreme velocity of the wind was 75 miles an hour, at 4.28 p. m. Considerable damage was done, one building being blown down and an occupant thereof sustaining severe injuries. Some of the streets were well-nigh impassable on account of uprooted trees, and telephone wires were broken in many places. The roof of a small restaurant building was blown for a block and some loose portions of the roof struck a passing street car laden with passengers, breaking several windows of the car, but injuring no one seriously."

During the severe thunderstorm in Springfield on the 6th, six men were rendered unconscious when lightning struck a tree near the tent of Maj. Davis at Camp Lincoln. All recovered. Telephone and electric light lines suffered severely and street-car service was demoralized. On the 28th another thunderstorm resulted in a fire in a furniture store in which stock and property to the amount of $45,000 was destroyed. Some street cars were reported to have been damaged also. A 10-year old boy, Ezra Haines of Mason City, was struck and instantly killed by lighting about 3 o'clock in the afternoon of the 9th. During the electric storm of the 29th at Pecatonia lightning struck a barn on a near-by farm, destroying the structure together with the hay and machinery stored therein. At Rockton lightning struck a greenhouse, destroying two buildings and their contents. A severe electric and wind storm swept over Shelbyville between 8 and 9 o'clock on the night of the 13th. In this storm there is indisputable evidence of tornadic action. Observers report a funnel-shaped cloud, which left a path of destruction 1,500 feet wide. A house was struck by lighting and burned and a church was badly damaged as were several residences. No lives were lost. S. P. Peterson, observer La Salle, Ill., reports as follows: "A severe thunderstorm occurred on the 1st. A large barn in this city was struck by lightning and destroyed. The loss is estimated at $3,000." Unusually large hail fell at Bloomington on the 28th, some stones measuring 1½ inches in diameter. There was no great damage. Forest City was visited by a severe storm on the afternoon of the 28th. Considerable damage was done to property.

By V. H. CHURCH, Section Director, Indianapolis, Ind.

Thunderstorms were very frequent and were accompanied in some instances by excessively heavy local showers. A fall of 3.19 inches was recorded at Plymouth

on the 7th. Two and eleven one hundredths inches fell at South Bend on the 13th, more than one-half of which fell within a very few minutes, causing some damage in the business section of the city by the flooding of basements. A storm on the 30th at Plymouth was accompanied by hail. The observer at Plymouth states that no damage resulted from it at Plymouth, but that crops in the eastern half of Marshall County were injured to some extent. The observers at Knox and South Bend recorded 13 thunderstorms at their respective stations.

A PHENOMENALLY HEAVY RAIN AT ALTON, ILL.

By MONTROSE W. HAYES, District Forecaster, St. Louis, Mo.

During the summer half-year local thunderstorms accompanied by rainfall of several inches occur frequently enough to cause no more than passing comment, and doubtless there is no locality to the east of the Rockies that has not a record of a rain of 4 or 5 inches in less than 24 hours, which is popularly referred to as a "cloud-burst." While 24-hour rains of 4, 5, or even 6 inches probably have fallen once or twice in many sections of the central part of the country in the last 30 or 40 years, when the fall gets much above 6 inches it should have a place in the list of very unusual phenomena.

At Alton, Ill., there was a rain during the night of July 13–14 that was, it is believed, unprecedented in the meteorological history of the middle Mississippi Valley.

July 13 was seasonably hot; at 7 p. m. there was an atmospheric depression over eastern New Mexico and southeastern Colorado, and a deeper depression extended from northern Nevada into North Dakota, with its center over eastern Montana and western North Dakota. There was an area of high pressure along the entire Atlantic coast, but the difference between the pressure extremes was only 0.62 inch. The weather was generally fair in all the territory to the east of the Rockies.

About 8 p. m. of the 13th occasional flashes of lightning were observed just above the horizon, in all directions. The display became more brilliant gradually, and shortly after 9 p. m. the whole sky was illumined by almost incessant sheetlike flashes. This continued, but with an increasing intensity, until about 12.50 a. m., when loud peals of thunder were heard and torrential rain began. Peculiarly, there was very little loud thunder during the first half of the night, although there were flashes, one following the other with an almost imperceptible intermission at all points of the compass. The flashes up to 12.50 a. m., or the approximate time of the first loud thunder, were mostly sheet lightning. As nearly as could be ascertained, light rain began about 11 p. m.; the heavy rain fell from 12.50 a. m. to 4 a. m.; more than 9.22 inches fell in the entire storm. There is no rain gage in Alton; the nearest is in East Alton, five miles from the part of Alton in which it is thought the precipitation was the heaviest; this gage caught 5.60 inches. In Alton several empty buckets and jars that had been left in places favorable for the measurement of rainfall were filled; after applying the formulæ to ascertain the value of the contents of these vessels in inches and hundredths of rainfall, it was found that the deepest contained 9.22 inches. An empty washtub left in a yard overnight caught 9.50 inches, but was not filled. Unfortunately, the exact dimensions of this tub were not known and a reduction of the 9.50 inches could not be made.

The following evidences of the amount of rainfall were obtained from reliable sources by Mr. L. D. Yager, of Alton:

1. At the home of Reinhold Gossrau, 430 East Ninth Street, being about six blocks east of Ninth and Belle Streets, where the great damage was done, three buckets, to wit, a candy bucket, and two ordinary iron buckets, were in the yard, free from drippings or other outside influence. Saturday night they were empty; Sunday morning they were full.

2. At the home of Hon. John J. Brenholt, corporation counsel of the city of Alton, there were five concrete pillars set for the outside of a porch. They were a foot square, with 2-inch solid concrete on the outer edges, leaving a space 8 inches hollow in the center. In these columns there were found to be 7 inches of water after the great rainfall.

3. At the home of Joseph Curdie, 1607 Henry Street, an ordinary iron bucket left in the yard, and being out in the open, was found filled in the morning.

4. At the home of Mrs. Elizabeth Harris, 920 Burns Street, a tub left in the yard was found to be full Sunday morning; also, an iron bucket that had been placed on the cistern box on Saturday evening, in an empty condition, was found filled on Sunday morning.

5. At the boat dock of W. D. Fluent there were about 12 skiffs, all of which were overflowed within an hour after the heavy rain began. The heavy downpour began about 10 minutes to 1 o'clock on Sunday morning. Taking into account the flare of the skiffs and the curvature from stem to stern, it would be reasonable to assume that the actual depth was about 40 per cent of the depth measured. The skiffs average about 14 inches deep, making approximately 5.6 inches of rain in the first hour. Mr. Charles Norman, who was in charge of the dock, estimates the rainfall between 8 and 10 inches from 12.50 to 3.30 Sunday morning.

6. William Bradish, of 728 Langdon Street, states he is a member of the firm of Webb & Bradish, having a boathouse at the foot of State Street. They had 14 skiffs in the water, and when he came down early Sunday morning all the skiffs were filled with water. The 40 per cent estimate ought to apply here.

7. At the Equitable Powder Co.'s plant a rain gage had been established on account of a lawsuit involving rainfall. This plant is 5 miles east of the main point of destruction in Alton, and it is generally conceded that the rainfall at the powder plant was not so heavy as in Alton proper. On account of the flood no reading of the gage could be made until 2 p. m., Monday, July 15. The gauge then showed 5.6 inches, and it was estimated by Theodore Masel, the mechanician of the company, and Richard Stout, secretary, that the evaporation amounted to enough to have made the rainfall at the end of the storm to be about 6.5 inches. The gage used is practically the same as used by the United States Weather Bureau, having an 8-inch opening at the top.

8. At the store of Mr. Baum, in West Alton, Mo., about 4 miles southwest of the main point of destruction in Alton, there were two milk jars left in the yard on Saturday evening and in an empty condition. The jars are about 10 inches deep and the sides are straight up and down. These jars were found filled with water on Sunday morning.

9. L. D. Yager, compiler of this report, watched the storm from 12.50 a. m., Sunday until 3.30 a. m., same day. At first wind and clouds were from the east; at about 2 a. m. the wind and clouds were from the south, and at about 3 o'clock the wind and clouds were from the west, indicating that the storm hovered over the city and really crossed three times.

The damage done by water (there was practically no damage by lightning) was greatly augmented by the topography of Alton, which is an unusually hilly place. Belle Street, the scene of the greatest hovoc, lies between two precipitous hills, and its extremity farthest from the river is steep.

At Twelfth and Belle Streets the water was over the curbstones at 1.15 a. m. After this the rate of rise is problematical, but mud lines on houses in Belle Street, below the steep portion of the thoroughfare, show that at some time there was a torrent 7 feet deep. In the principal business portion of the city the water was 2 to 3 feet deep and much damage was done to goods. Basements were filled with water and a heavy deposit of mud was left.

A 7-foot masonry sewer in Belle Street gave way in several places under the hydrostatic pressure and the street was washed out to a depth of 20 feet. This sewer gave way under the Alton Gas Works and a portion of the plant was wrecked. Small houses were washed away and in numerous houses several inches of mud was left on the first floor. Four persons were drowned by being caught in low-ceiled rooms. In some of the other streets paving bricks and macadam were washed out and the street bed eroded several feet.